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A fossil species of the primitive mymarid genus *Borneomymar* (Hymenoptera: Mymaridae) in Eocene Baltic amber

Michael S. Engel¹, Ryan C. McKellar^{1,2}, & John T. Huber³

Abstract. A new fossil species of fairyfly (Hymenoptera: Chalcidoidea: Mymaridae) is described and figured from a well-preserved female in middle Eocene (Lutetian) Baltic amber as *Borneomymar pankowskiorum* Engel, McKellar, & Huber, new species. This species represents the fourth genus from Baltic amber whose extant species now occur only in southeastern Asia, Australia, and Madagascar.

INTRODUCTION

Like most Chalcidoidea, the fossil record of Mymaridae is scant. Huber & Greenwalt (2011) and Poinar & Huber (2011) reviewed the fossil taxa and illustrated the five known Cretaceous genera. Huber (2002) discussed extant taxa purported to occupy relatively basal positions within the family and proposed a hypothesis of their early diversification. *Borneomymar* Huber was placed almost at the base of the putative phylogeny. The genus is currently known from three species distributed from Malaysian Borneo (Sarawak and Sabah), Sulawesi (Indonesia), and northern Madagascar (Huber, 2002). Like several other extant genera of Mymaridae, species of *Borneomymar* have 5-segmented tarsi and an 8-segmented funicle. Based on recent discovery of the male,

¹ Division of Entomology, Natural History Museum, and Department of Ecology & Evolutionary Biology, 1501 Crestline Drive – Suite 140, University of Kansas, Lawrence, Kansas 66045, USA (msengel@ku.edu; ryan.mckellar@ku.edu).

² Department of Earth and Atmospheric Sciences, University of Alberta, 1-26 Earth Sciences Building, Edmonton, Alberta, T6G 2E3, Canada (rcm1@ualberta.ca).

³ Natural Resources Canada, c/o Canadian National Collection of Insects, Arachnids and Nematodes, K.W. Neatby Building, 960 Carling Avenue, Ottawa, Ontario K1A 0C6, Canada (john.huber@agr.gc.ca).

one of the described species is almost certainly misplaced and will be removed from *Borneomymar* (Huber, unpubl. data). The other two differ from the other basal genera by having the ovipositor greatly elongate and exerted beyond the apex of the gaster by more than twice the body length. The biology of species of *Borneomymar* is unknown, but Huber (2002) speculated that they may be parasitoids of Orthoptera eggs oviposited deeply in plant tissue.

A specimen of *Borneomymar* obtained from middle Eocene (Lutetian) Baltic amber is described here and compared to its closest living relative, from Madagascar. Some insight is also provided regarding the climate in the Baltic area of Europe that was likely prevalent during the Eocene.

MATERIAL AND METHODS

The extinct species described here is known from one specimen preserved in a light yellow piece of Baltic amber, relatively clear of debris and other inclusions. The amber piece was lightly ground and polished along one side to permit a clearer view of the specimen. Morphological terminology and descriptive details follow those of Huber (2002). Measurements were made with an ocular micrometer on an Olympus SZX-12 stereomicroscope and are given in μm . The extant species, *Borneomymar madagascar* Huber, was photographed with a digital scanning camera attached to a microscope, and the resulting layers combined electronically using Zerene Stacker® and retouched as needed with Adobe® Photoshop. Institutional abbreviations include: AMNH, American Museum of Natural History, New York, New York, USA; CAS, California Academy of Sciences, San Francisco, California, USA; GMGD, Geowissenschaftliches Museum der Universität Göttingen, Göttingen, Germany; SEMC, Snow Entomology Museum Collection, Division of Entomology, University of Kansas Natural History Museum, Lawrence, Kansas, USA; UCR, University of California, Riverside, Riverside, California, USA.

SYSTEMATIC PALEONTOLOGY

Genus *Borneomymar* Huber

Borneomymar pankowskiorum Engel, McKellar, & Huber, new species

ZooBank: urn:lsid:zoobank.org:act:41C2B38E-DC7B-4BAA-A5D6-E6C590C7074D

(Figs. 1–4)

DIAGNOSIS: The new species (Figs 1–4) is most similar to the extant species *B. madagascar* (Fig. 5). It differs by having the legs and scape–funicle segment 1 light brown (yellow in *B. madagascar*) and proportionally shorter marginal setae (ratio of longest marginal setal length/maximum forewing width 0.57 for the fossil species, versus 0.76–0.86 in *B. madagascar*). The new species differs from the extant species *B. discus* Huber by its uniformly clear wings (distinctly patterned with brown in *B. discus*) and shallower gaster (deeper, almost circular in *B. discus*).

DESCRIPTION: ♀: Total body length (excluding ovipositor) 1010; exerted ovipositor ~2540; head length ~230; mesosomal length 430; metasomal length 490 (without hypopygium); forewing length 1040, width ca. 200 (angle precludes accurate width measurement); longest marginal setae 113; hind wing length 670, width ~30; antennal proportions (scape, pedicel, funicular articles, clava) 90, 50, 60, 80, 80, 80, 80, 70, 70, 70, 170; typical flagellar article width 30; width of apical clava 40.



Figures 1–2. Photographs of holotype female (SEMC F001019) of *Borneomymar pankowskiorum*, new species. 1. Left lateral habitus. 2. Right lateral habitus.

Color (as preserved) apparently pale brown throughout, with slightly darker regions along dorsal surface of mesosoma; wings uniformly hyaline, without dark markings (Figs. 1–3). Head shape taphonomically distorted, with vertex sunken, but ocelli still visible and arranged approximately in equilateral triangle, with lateral ocellus separated from margin of compound eye by two or more ocellar diameters and all interocellar distances approximately 1.5 ocellar diameters; clypeus rounded and slightly protuberant; mandible narrow, apparently with two blunt teeth on apex (but visibility is poor); toruli within one torular diameter of transverse trabecula; radicle short, much less than one-half length of scape; scape expanded within apical half; pedicel slightly wider than funicular articles; funicle with eight articles of relatively uniform lengths; clava slightly longer than apical two funicle articles. Mesosoma with gentle dorsal convexity; pronotum about one-half length of mesoscutum; mesoscutum 140 long, with low dorsal convexity; mesoscutellum length 120, anteriorly with low dorsal convexity, frenum flat with fine, transverse, anteriorly convex frenal groove near mid-length of mesoscutellum; metanotum with dorsellum 70 long, rhomboidal, and nearly flat; propodeum without visible sculpture and with gradual declivity. Forewing membrane with microtrichia apparently uniformly distributed (difficult to be sure due to wing angle but figured as such in figure 4; there may well be regions of membrane that



Figure 3. Detail of holotype female (SEMC F001019) of *Borneomymar pankowskiorum*, new species.

are glabrous); venation extending $0.66\times$ forewing length (venation length 690) (Figs. 3, 4); longest marginal setae $0.57\times$ as long as greatest wing width. Metasoma with short petiole, and with total length slightly more than mesosoma; gaster height about $0.4\times$ its length, terga of relatively equal lengths; posterior four terga bear short, inclined setae along posterior margins; hypopygium large, translucent, projecting distinctly beyond gastral apex (Figs. 1–3); ovipositor greatly elongate, much longer than twice entire body length (Figs. 1, 2, 4), without setae along exerted length.

♂: Unknown.

HOLOTYPE: ♀, SEMC F001019, middle Eocene (Lutetian), Baltic amber; fossil insect collection, Division of Entomology, University of Kansas Natural History Museum, Lawrence, Kansas.

ETYMOLOGY: The specific epithet is a patronym honoring the family of Mark Pankowski of Rockville, MD, who first recognized the significance of the specimen and made the acquisition of the holotype possible.

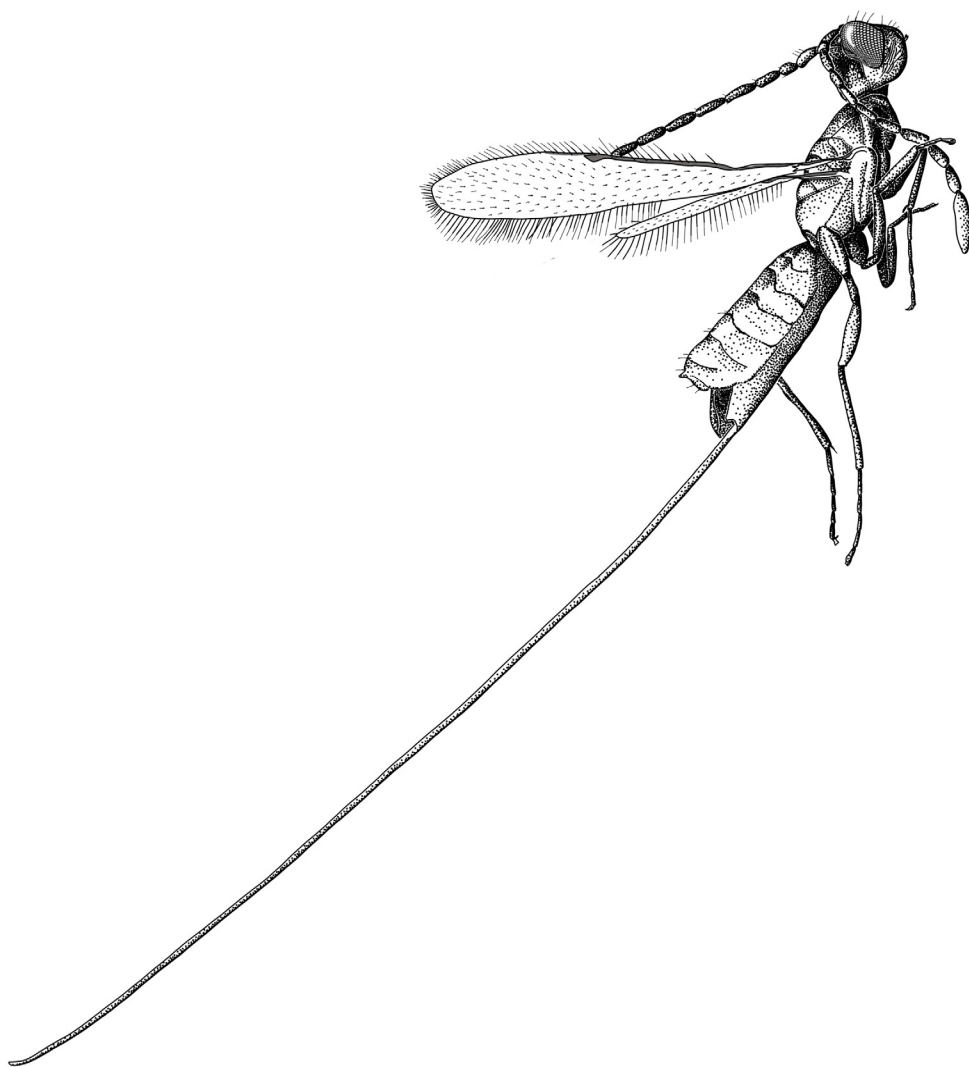


Figure 4. Habitus drawing of holotype female (SEMC F001019) of *Borneomymar pankowskiorum*, new species.

DISCUSSION

The new species is almost identical to the extant, basal mymarid *B. madagascar* (Fig. 5). The strong similarity in morphological details between these two species indicates that they are closely related, and supports interesting biogeographic implications, shared by other, unrelated taxa as well. Moreover, it demonstrates a remarkable degree of bradytely in a lineage of mymarids over a period of at least 45 million years. This morphological stasis suggests some degree of constancy in ecology and habits, perhaps even in terms of the clade of hosts, over a long duration of time and despite considerable climatic and geographic shifts (Simpson, 1944). Obviously, suitable biotic and abiotic conditions have persisted throughout this time, although their



Figure 5. Habitus photographs of female of *Borneomymar madagascar* Huber, from Madagascar: Fianarantsoa, Massif de Andringitra (CAS); lower left inset shows entire specimen; the center of the compound eye is collapsed (scale bars = 500 µm). Top inset shows head, anterior view (scale bar = 100 µm).

geographic centers have shifted, and permitted the lineage to avoid strong selection for morphological change, or extinction. This same phenomenon is known in various groups of insects, some of more than twice the geological age (Engel & Grimaldi, 2002; Clarke & Chatzimanolis, 2009; Cognato & Grimaldi, 2009; Chatzimanolis *et al.*, 2013). *Borneomymar pankowskiorum* represents the most primitive genus of extant Mymaridae that has been found in Tertiary deposits. No Cretaceous species of Mymaridae has yet been found in Tertiary deposits or vice versa.

The Eocene climate was the warmest of the Cenozoic and experienced the Paleocene-Eocene Thermal Maximum and Early Eocene Climatic Optimum, the latter comprising a nearly 200,000 year span of elevated global temperatures that began falling by the second half of the epoch. Regions that are cold temperate or even arctic today harbored rich tropical or subtropical floras and faunas (Engel, 2001; Archibald & Farrell, 2003; Grimaldi & Engel, 2005; Wappler & Denk, 2011; Wappler *et al.*, 2013). The specimen of *Borneomymar* described above is the third or possibly the fourth mymarid

genus that shows the Eocene fauna of Mymaridae, as represented in Baltic amber, was quite different from the extant mymarid fauna of the region. Other extant species known only in the Australian and/or Oriental regions but also represented in Baltic amber occur in *Mimalaptus* Noyes & Valentine (two specimens, GMGD and UCR), possibly *Dorya* Noyes & Valentine (identification not certain) (one specimen, UCR), and *Ceratanaphes* Noyes & Valentine (one specimen, Janzen Collection, AMNH). Such biogeographic ties between the Baltic amber fauna and lineages today surviving in the Australasian or sub-Saharan regions is relatively common, as shown by many genera present in the Eocene that have disappeared from Europe or the Northern Hemisphere generally and now occur only in the tropics or the Southern Hemisphere, particularly in the Australian and Oriental regions (Grimaldi & Engel, 2005). As the climate of the Polar regions and Northern Hemisphere cooled and dried, particularly following the Eocene-Oligocene transition and through the Miocene, various insect lineages tracked the retraction of tropical environments into more southerly positions. *Borneomymar* and the aforementioned additional three genera are collectively yet another example demonstrating the resemblance between the Eocene Baltic area and that now found only in the tropics or the Southern Hemisphere. Moreover, evidence from the current distribution of extant species in various taxa (not just insects) suggests that the Earth as a whole was climatically more uniform than today (e.g., Archibald & Farrell, 2003).

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Pharciphyzelus lacefieldi Beckemeyer & Engel, 2011

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